



Implications of land disturbance on drinking water treatability in a changing climate: Demonstrating the need for "source water supply and protection" strategies

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Year: 2011
Journal: Water Research. 45 (2): 461-472

Abstract:

Forests form the critical source water areas for downstream drinking water supplies in many parts of the world, including the Rocky Mountain regions of North America. Large scale natural disturbances from wildfire and severe insect infestation are more likely because of warming climate and can significantly impact water quality downstream of forested headwaters regions. To investigate potential implications of changing climate and wildfire on drinking water treatment, the 2003 Lost Creek Wildfire in Alberta, Canada was studied. Four years of comprehensive hydrology and water quality data from seven watersheds were evaluated and synthesized to assess the implications of wildfire and post-fire intervention (salvage-logging) on downstream drinking water treatment. The 95th percentile turbidity and DOC remained low in streams draining unburned watersheds (5.1 NTU, 3.8 mg/L), even during periods of potential treatment challenge (e.g., stormflows, spring freshet); in contrast, they were elevated in streams draining burned (15.3 NTU, 4.6 mg/L) and salvage-logged (18.8 NTU, 9.9 mg/L) watersheds. Persistent increases in these parameters and observed increases in other contaminants such as nutrients, heavy metals, and chlorophyll-a in discharge from burned and salvage-logged watersheds present important economic and operational challenges for water treatment; most notably, a potential increased dependence on solids and DOC removal processes. Many traditional source water protection strategies would fail to adequately identify and evaluate many of the significant wildfire- and post-fire management-associated implications to drinking water "treatability"; accordingly, it is proposed that "source water supply and protection strategies" should be developed to consider a suppliers' ability to provide adequate quantities of potable water to meet demand by addressing all aspects of drinking water "supply" (i.e., quantity, timing of availability, and quality) and their relationship to "treatability" in response to land disturbance.

Source: <http://dx.doi.org/10.1016/j.watres.2010.08.051>

Resource Description

Communication:

resource focus on research or methods on how to communicate or frame issues on climate change;
surveys of attitudes, knowledge, beliefs about climate change

A focus of content

Communication Audience:

audience to whom the resource is directed

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Policymaker

Other Communication Audience: Water managers

Exposure : 

weather or climate related pathway by which climate change affects health

Ecosystem Changes, Extreme Weather Event, Food/Water Quality

Extreme Weather Event: Wildfires

Food/Water Quality: Chemical

Geographic Feature: 

resource focuses on specific type of geography

Freshwater

Geographic Location: 

resource focuses on specific location

Non-United States

Non-United States: Non-U.S. North America

Health Impact: 

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

Intervention: 

strategy to prepare for or reduce the impact of climate change on health

A focus of content

Mitigation/Adaptation: 

mitigation or adaptation strategy is a focus of resource

Adaptation

Resource Type: 

format or standard characteristic of resource

Research Article

Resilience: 

capacity of an individual, community, or institution to dynamically and effectively respond or adapt to shifting climate impact circumstances while continuing to function

A focus of content

Timescale: 

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time period studied

Time Scale Unspecified

Vulnerability/Impact Assessment:

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content